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Working Paper on Seismic Investigation Proposal

The United States is now prepared to take action in connexion with its proposal of December 5, 1968, to the First Committee of the 23rd United Nations General Assembly, that certain underground nuclear explosions serve collaterally for studies in connexion with worldwide seismic investigations.

As indicated in the U.S. proposal, all states with appropriate seismic instrumentation will have the option to collect and evaluate seismic data resulting from such explosions, and the success of the proposal will depend in large degree on the extent to which they exercise their option. Presuming broad participation in the procedures foreseen by the United States, the experiments will have a threefold result; they will facilitate further analysis of seismological characteristics, both of the geological media and of the explosions themselves; they will provide a basis for systematizing worldwide use for seismic purposes of the information released on underground nuclear explosions; and they will facilitate worldwide evaluation and comparison, to the extent that the data are exchanged, of the seismic information gathered on such events.

The underground nuclear explosions contemplated by the U.S. for these experiments will not involve development or testing of nuclear weapons.

The purpose of this working paper is to elaborate on the first of these experiments and on how it would apply to the seismic investigation proposal. The experiment, denoted Project Rulison, will be conducted in the state of Colorado in the Western United States.* Like a previous experiment (Project Gasbuggy) conducted in December 1967, its purpose will be to investigate the use of a nuclear explosion to increase the recovery of natural gas. The explosion will have a yield of about 40 kilotons. It will take place in a low permeability gas-bearing formation, geologically referred to in this region as the Mesa Verde formation. The explosion

* Originally scheduled for June, the experiment has for technical reasons been postponed until September.

is expected to create an underground chimney of broken rock about 370 feet high and 160 feet in diameter. The chimney thus created will act as a chamber where the gas will collect and then be drawn off through a well to be drilled from the ground down to the chimney. The energy released by the explosion is expected to crush and fracture the rock out of about 290 feet around the chimney, thereby greatly increasing the permeability of the reservoir and enabling the gas to flow more readily to the producing well.

With regard to the seismic investigation aspect of this experiment, the following data are pertinent:

1. The depth of the explosion will be 8443 feet.
2. The precise site of the explosion will be 39 degrees, 24 minutes, 21 seconds North Latitude and 107 degrees, 56 minutes, 53 seconds West Longtitude.
3. The general geology in the vicinity of the depth for which the explosion is planned is basically shale, with some sandstone.

Approximately two weeks before the experiment, the United States Coast and Geodetic Survey will alert seismic stations worldwide by telegram. In addition to providing technical details, the messages will request the transmission of seismic data back to the United States Coast and Geodetic Survey for incorporation into an overall analysis. Similar messages will also be sent to the World Data Centres for Geophysical Data in Moscow and in Strasbourg, and to the International Seismological Centre in Edinburgh. Following the experiment, the actual time of the explosion, the depth, the yield, and the preliminary estimate of the seismic magnitude will be furnished through the same channels.

Data from the explosion collected in the United States will be available to others from the World Data Centre at the U.S. Coast and Geodetic Survey in Washington, D.C. The United States Coast and Geodetic Survey will in turn assemble data collected from outside the United States, as well as inside, and will prepare a report which will include computations, using all the available seismic data, of the calculated location of the explosion, the origin time, the yield of the explosion, and the seismic magnitude. The report will also include an analysis of the data using seismic identification criteria for distinguishing between explosions and earthquakes.

Since the original seismic data will also be available from the U.S. and other World Data Centres, other interested states and organizations will, of course, be able to subject it to their own analyses independent of the U.S. analysis. The results of this experiment, and of such others as may follow it, can then be discussed in relevant scientific and technical forums.

Because of the yield of this experiment and the geo-physical characteristics of the medium in which Project Rulison will be conducted, it may be that this event will be identified as an explosion through teleseismic means. It must of course be recognized that this experiment by itself cannot be expected to permit definitive conclusions regarding seismic detection and identification capabilities. On the other hand, judging from responses already received indicating interest in participation, there are reasonable grounds for expecting that the seismic investigation aspect of Project Rulison will achieve the specific and limited objectives intended for it and provide the threefold result outlined on page 1.